Analysis of the short serve in Badminton and training to improve the short serve

Jodie Cochrane Wilkie, James Croft, Anthony Blazevich and Shayne Vial
Edith Cowan University

ABSTRACT

Introduction

In an elite doubles badminton environment, the serve is thought to be the most important shot of a rally (Edwards, et al., 2005; Renick, J., 1977) because an accurate serve can put the opponent in a defensive position and have a significant impact on the outcome of the point. The short serve is one of the most commonly used serves in doubles and requires the server to strike the shuttlecock with precision in order to achieve an accurate serve and gain an advantage in the rally. The optimal trajectory of the short serve can be described as a trajectory with the apex occurring prior to passing over the net with a steep drop-off angle. The goal is to force the opponent to hit the shuttlecock high at a steep angle in order to clear the net, allowing an offensive player to hit the shuttlecock from a high point, from which it is easier to score. Currently, analysing the short serve is left to subjective measures, coaches observe technique and performance and provide critique and feedback. There is a distinct lack of published research available to coaches and players in badminton which can be used for coaching the athletes and advising the development of training programs. This research aimed to investigate the movement patterns associated with the accuracy-based skill of the short serve, and; understand how elite players vary their movement when performing the short serve. Additionally, a training program was developed and implemented aimed at improving short serve accuracy and the effectiveness of this training intervention was assessed.

Methods

The first part of the research investigated the techniques and movement patterns associated with accuracy in performing a short serve and the role of movement variability in short serve accuracy. Eight players were recruited from the Senior Australian National Doubles Badminton squad (mean age: 23.4 ± 5.1 years) and performed 160 serves (80 from each side of the court to two targets) each with an opponent present to simulate match conditions. Serves from one side toward the centre line (40 serves) were analysed. The player's short serve technique and serve accuracy (determined by assessing the shuttlecock trajectory, apex position and height) was examined using three-dimensional motion analysis. Twenty-two VICON motion analysis cameras (Oxford Metrics Ltd., Oxford, UK) sampling at 250 Hz were positioned around the badminton court. The cameras captured the retro-reflective markers on the racquet, shuttlecock and player. To examine which movement patterns are associated with greater accuracy in the badminton short serve the three-dimensional kinematics were analysed using a principal component analysis. To investigate the role that movement variability plays in the precision-based movement of the short serve biological variability was examined.

The second part of the research focused on developing a training intervention to improve the players' short serve accuracy. Nine players from state and university level badminton (mean age: 20.4 ± 6.4 years) participated in in two testing sessions, one prior to the short serve training intervention (pre-testing) and one following the completion of the training (post-testing). Players performed 80 short serves (40 from each side of the court) targeting the ground where the centre line intersects the short service line. Serves from one side toward the centre line (20 serves) were analysed. The motion-capture system consisted of 8 cameras in session and collected with a sampling rate of 1000 Hz (VICON Oxford Metrics Ltd., Oxford, UK). Reflective tape was placed around the base of the head of the shuttlecock to track its trajectory. A training program was developed based on the results of the first part of the research. Players completed eight training sessions over 4 to 6 weeks. The training focused on improving the trajectory of the short serve. The players were instructed to serve the shuttlecock through one of the three different targets. The targets forced the player to serve with a trajectory which had the apex before the net and the shuttle height above the net was low. This trajectory was proposed to be most accurate and difficult for the opponent to return effectively. Over the eight training sessions the difficulty increased with targets being lowered and the gap for the shuttlecock to pass through being reduced. Following completion

of the training players did the post-testing session which replicated the pre-testing session. Shuttlecock position at apex and height over the net was calculated. Median apex location and median net clearance for each player and the group was calculated. An accurate serve had apex location closer to the server than the median and net clearance below the median.

Additionally, an investigation into the predicted landing position of the shuttlecock in a game-like situation was undertaken to determine if future training should continue to target locations on the ground of the badminton court or should involve an opponent.

Results and Discussion

Results from the first part of the research showed that all of the players used a similar yet slightly different versions of a push-like movement pattern. The more accurate players used a simplified push-like movement pattern, suggesting that reducing the complexity of coordinating multiple joints in several planes to a single plane is key to short serve performance in elite badminton players. Higher medio-lateral (transverse plane) variability was displayed in most joint angles across all players. This strategy incorporated variability in the task-redundant dimension (transverse) to reduce variability in the task-relevant dimension (sagittal), which directly impacts on the accuracy of the serve. Variability was also present in the timing of the swing, varying the timing of the backswing to reduce the variability at the contact point was a common feature displayed across all subjects, irrespective of whether the serve was accurate or not. Our findings suggest elite badminton players use joint and timing variability in a functional capacity, and they limit variability in movements that have an effect on the serve accuracy, such as elbow flexion/extension.

Results from the second part of the research demonstrated that the training intervention was effective at improving the short serve accuracy. The group median for shuttlecock apex location and height above the net was 179mm and 231mm, respectively in the pre-testing session and following the training the group median improved to 65mm for the shuttlecock apex location and 191mm for net clearance (height above the net). Therefore training focusing on optimising the shuttle trajectory in the short serve results in an improvement in accuracy of the short serves, and focusing on extrinsic factors such as the shuttle path is beneficial and players make intrinsic adjustments in technique to achieve the desired shuttle trajectory.

The development of a model enabling the prediction of where the shuttlecock would land when the opponent was present was undertaken and the results showed that 69% of serves landed on or short of the service line. This suggests that serving to an opponent could result in a different trajectory because the server knows that the opponent will hit the shuttlecock before it lands. Practicing serving to floor targets ignores the criterion of successful serves (apex position) that is realised when serving to an opponent or when focusing on training the optimal trajectory.

Conclusion

This research provides a greater understanding of the biomechanics of the short serve and movement patterns related to accuracy and the role of movement variability. A simplified, push-like movement pattern allows the racquet to follow a linear or flat arc path, leading to greater accuracy. Segmental rotations occur simultaneously which would be a key coaching point, allowing more control over the racquet, ensuring better consistency at the racquet-shuttlecock contact point. Due to variation in players it is difficult to provide an optimal technique for all but these particular movement patterns can be used in providing coaching of technique. The research also demonstrated that training focusing on the optimal trajectory for the short serve (apex before the net and low net clearance and sharper drop off after passing the net) is beneficial and players are able to improve the accuracy of their serve. It is recommended to also train in a similar way focusing on optimising the trajectory of the shuttle whilst serving to an opponent.

References

Edwards, B.J., K. Lindsay, and J. Waterhouse, *Effect of time of day on the accuracy and consistency of the badminton serve.* Ergonomics, 2005. 48(11-14): p. 1488-98.

Renick, J., Tie point strategy in badminton and international squash. Res Q, 1977. 48(2): p. 492-8.